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Design and Development of Multifunctional Robot for Military Purpose Applications

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ABSTRACT

Robots are specially design for human to make our life easier. Robots are design for various purposes like military purpose, industry, for home based application. At border different tanks, missile, guns etc are used by enemy. This cause problem and harm our force or soldiers. For this a robot is design and developed for military purpose application to protect our army. The method involving two legged bipped walking robot using parallel leg mechanism i.e. PLM which includes different functions like capturing real world data using digital image processing used to detect its obstacle which is found in its path. If it found any obstacle in its path then using gun mechanism it will able to shoot that obstacle. For making it multifunctional robot all the actions perform by user same actions perform by robot using stretch sensor. All these mechanisms are embedded on the propeller IC. This is a wireless robot communication takes place between server and client by using wifi through Winsock i.e., window socket.

Keywords - Multifunctional Robot, PLM, Propeller IC, Winsock

I. INTRODUCTION

Robots are design for various purpose applications. There are two kind of methods of controlling the robot which is wired and wireless. The wireless robots are more convenient than wired Robot in terms of its range. The size of the wireless robot is large and cost is high as compare to wired robot. But for long distance communication purpose wireless robots are used specially used in unfavorable condition like fire rescue area, toxic gas area in such places these robots are used with much high efficiency [1].Biped robot is the new and recent technology. These biped robot are used to advancement in lower body prosthesis has helped in war veterans and effected soldiers to win their back normal life with certain limitations [2]. For detecting its obstacle in its path robot should able to learn its surrounding view for that preprogramming or training is need to be embedded to the system to analyze its view and environment. Normally it is difficult to train the system this learning mechanism may require information about a border environment as we design for military purpose and all data base feed in its memory [3]. Most of the robot there is a problem of task assignment and communication set up between user and robot. Different camera and sensors are used to detect obstacle. It is capable of finding its obstacle from source to destination [4].

In this we are design a multifunctional robot which performs multiple operations like motion in different direction. Gun mechanism used in robotics

system is depending upon the combination of performance and workload of gunner and robotics operator. For shooting exact target distance measurement and calculation of distance and direction is to be done. This gun mechanism is used to protect soldiers and itself robot. During war if anyone tries to harm the robot at that time robot will able to protect itself from enemy [11]. Robots are inspired by different technology like human morphology which includes biped's robot such as Honda's ASIMO, HRP-2and Johnnie as discussed in sakagami et al. [2002].Hirukawa et al [2004]. In [2004] Asano, Lou and Yamakita use energy based controller to design innovative idea to build controller walking machine. Most of the robot built are based on active control technique but that all are too complicated require more power and highly expensive.

II. RELATED WORK

Dynamic walking in bipedal robotics is most interesting topic in recent years. As in dynamic walking motion is fast as compared to static walking.In 2013 Haslina Jaafar, Azura Che Soh, Wan Zuha Wan Hasan, Mohammad Hamiruce Marhaban and Shaufiq Abd Rashid propose a Flipper robot has been designed and developed which has capability to fight with other robots. Flipper robot is a wireless robot that can move wirelessly and also be able to immobilize other robot using pneumatic system. Interface Free Controller (IFC) is used as the brain of the robot to control the robot movements where all

the data and information are processed. C language is used to program this microcontroller via MPLAB, so that it will function as desired.

In 2012 Sachhal Mufti and Muhammad Naveed Alam design a Self-Navigated Autonomous Biped Robot using Rug Bat Sonar sensors and Modular Digital Image Processing and limiters embedded within the MATLAB environment. The method involving the use of sonar and ultrasonic sensors for computing and analyzing path in real-time and avoiding obstacles based-on the computational algorithm Embedded on the micro-controller. Ivan Mezei, Veljko Malbaša, Ivan Stojmenović in 2012 design a way of networked robot to maintain functionality of sensor networks.

III.   PROPOSED WORK

The methodology to be followed for the project is as follows:

In this the robot has been designed and developed which has capability that can move using parallel leg mechanism i.e., we are designing bipped robot and used for surveillance operation in military border area. For surveillance we use image processing concepts. Using camera it detect object then it send alert to the control room where user can perform all operation at that time robot check during the object detection

Whether that object try to do any harm on robot if yes then it uses gun mechanism in which gun protect robot from any harm. The gun will rotate horizontal and vertical direction as at border there is an order of shoot at sight as the gun found any person or if any bird then the gun will shoot it but if that obstacle is member of designer team then there is already pre saved database. The shooting of any object is done by identifying the friend and foe.

It also have another feature it can mimic all the action by controller from control room to place where robot present for that robot wear jacket in that stretch sensor is used were all the operation perform wirelessly and all the program embedded in propeller IC which is manufacture by parallax This is 40 pin IC inside this microprocessor 8 processor are inbuilt for synchronizing it's all multiple operation. For wirelessly connection we are going to use Wi-Fi which is of having range of 100m.
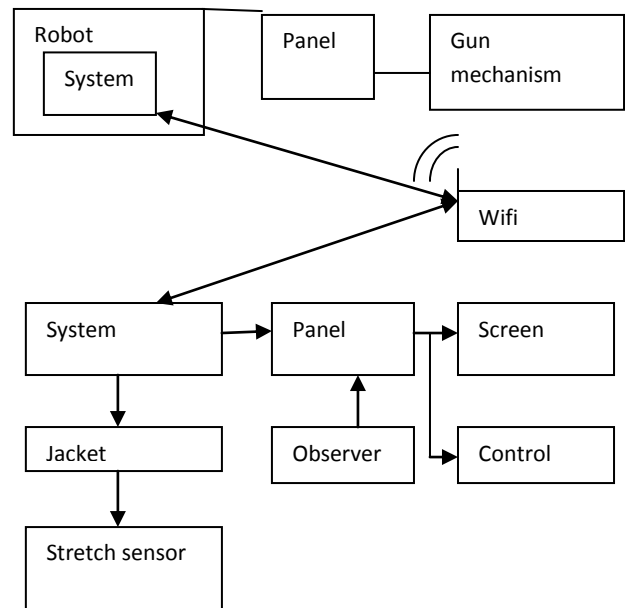

Fig. 1.Shows all mechanism used in Multifunctional Robot

A. Mechanical Design of Biped

Design of leg can be done using PLM mechanism, Serial link mechanism and using balance algorithm. But as compare to serial link mechanism PLM mechanism is more superior in terms of identical component, even distribution of weight and absence of error build up. In PLM links and their joint connection do not vary from leg to leg so it helps to reduce cost but in serial link mechanism it does not have this intrinsic repetition of components so it increase its production cost. As PLM is superior to serial link mechanism we are using parallel leg mechanism for designing standard leg.

A standard human leg design using parallel leg mechanism in which 3 servo motor is used in ankle, knee and hip movement. There is hip-roll and ankle-roll also exists, giving us a minimum of 5 DOF for designing a "standard leg". There is hip roll and ankle roll also exists with minimum degree of freedom this mechanism is called parallel leg mechanism (PLM) and the number of independent ways by which a dynamic system can move without violating any constraint imposed on it, is called degree of freedom (DOF).

To provide motion stability, the shifting of the center of the mass is achieved by tilting the robot body to a specified angle on each side during the motion. This tilting mechanism is designed by using the cam follower, and its passive motion is obtained by the main driving motor. The profile of the cam connected to the main crank of the robot is very precisely calculated and designed to achieve the requisite tilting. The amount of the tilt is wholly dependent on the profile of the cam; the angle of tilt

of the robot body is calculated by the analysis of the biped's center of mass at three different positions i.e. left most, middle and right most. The center of mass (COM) of the robot in different positions is calculated by using the relation. Metal sheet is too heavy to design the body of robot so we use Acre nil sheet for designing the body of robot. MG995 servo motor is use which is manufacture by tower pro which generates 9-12V torque. There are total four configuration of these servo's 90° stock rotation, 180° modified rotation, continuous rotation and reverse rotation.

Servo's motors are used to for the rotating movement of robot. For designing leg 6 servos will require per leg. As seen in above figure 2 servo's are in hip joint, 2 servo motor used as knee and 2 servos' are in ankle of the leg. Upper most servo will use to move leg in rotation direction, below this front servo is use to move leg in left and right direction and the back side servo is use to for move leg in upward direction. The complete mechanism of these three servos is called parallel leg mechanism (PLM). The front servo which is connected to ankle is used for front and back movement and servo which is connected to the back side of ankle is use for its ankle movement is left and right direction. The upper body should also of light weighted because if it's too heavy unable to balance for leg.

B. Motion Detection and Face Recognition
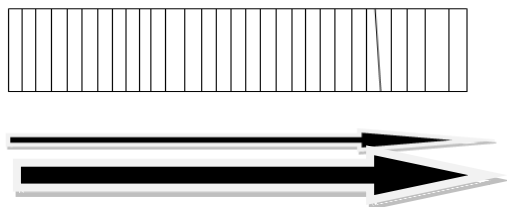Technology Used for Motion Detection is FPS technique i.e., frame per scaling.

Fig. 2.Shows 30 frames in one second.

Video is collection of frames in this technique we use 16 MP cameras for capturing real world data, in one minute 1800 Frame will detected. Large no. of frames brings slow performance. Depreciation & scaling is must. The difference between the previous capture image and present image is called scaling. In FPS technique first, middle and last frame is detected.
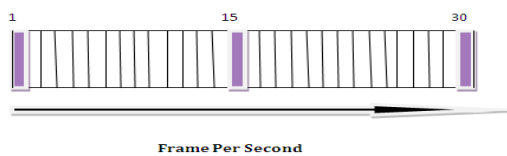

Fig. 3.Shows frame per second

Hence in one minute 3* 60= 180 frame is calculated. This will increase performance, efficiency & speed.

C. Image Processing
This includes capturing the real world data, converting it into digital form and then processing the digitized data. Cameras will capture the surrounding view. The robot will be trained to recognize various objects in the view field. Depending upon the objects and their distance the system will calculate the distance and the direction through which the robot will recognize enemy on border area. As it recognize any object it send alert to control system and during that duration if enemy try to harm that robot, robot will use gun mechanism for his protection.

IV. NETWORK COMMUNICATION
Literature lacks solutions for concrete task assignment scenarios in presence of robot mobility and for designing any communication system few points should consider like cost and efficiency. In most of the papers, task assignment problem is formulated as a variant of integer linear programming problem. The most commonly used method for making communication is client server model. In this model client send request services to server computer. This implies symmetry in establishing network between client and server. Client place inside the robot and a mini computer which is act as server is place within a distance of 100m which is the range for wife network for that wife network is required. Communication between two computers can be done by Windows Sockets (Winsock). Windows sockets are the communication media through which communication has been establish. Client computer present near the robot from where requests send to main server room where panel is there. As we send any command from panel robot will activate and send information back to main server room.
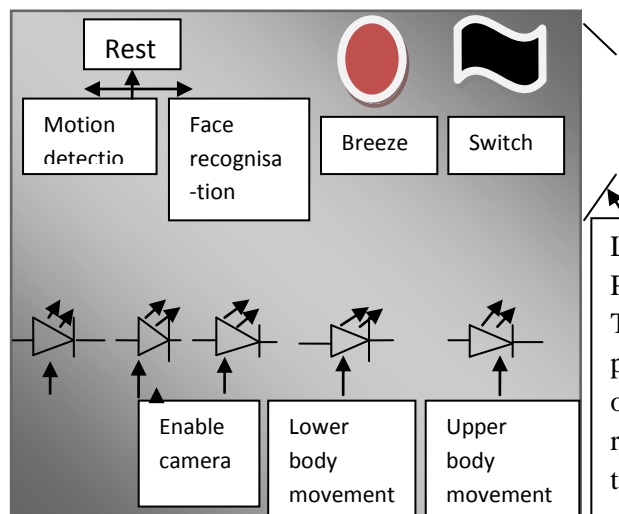

Fig. 4.Shows panel which is connected to the server

Above panel shows all the functions in which when upper right side switch is move toward right then is used to detect motion and if it moves toward left then it used to recognize face. There are five LED and switches are given for its multiple operation first one is use for robot upper body movement, second one is use for lower body movement, third switch is use for enable camera to detect obstacle and last two switch remain free as future use. Red color button is called breeze to stop the all functions or operations of robot. For performing all the operation we have to provide 5V from LPT port pin no. 1 that is strobe pin which send value (255) as it pass the value the switch where activate.

V. RESULTS

a. Start engine for establishing the communication

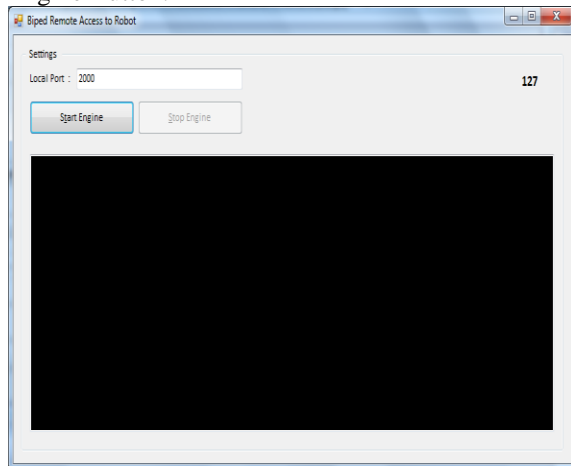Insert The Local Port Value Clicking On The Start Engine Button.

Fig. 5 .Start Engine for Establishing the Communication

b .Communication establish between client and server

After clicking on start engine button value is send to server system and connection is establish is shown in this window. As we turn on upper body movement button the LED will glow and the value which we are given to this button is transmitted from server to client system same operation will be followed by the lower body movement button and enable camera button and the last two buttons are used for future use.
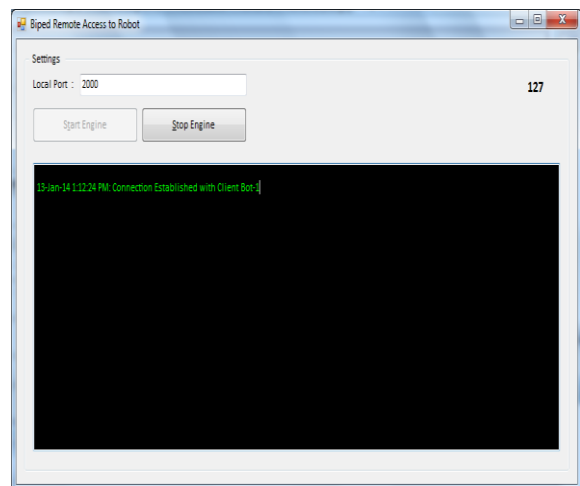

Fig. 6.Communication establish between client and server

The above result shows how connection between two systems is setup.

VI. CONCLUSION

In this work communication of network between server and client, bipped robot and motion detection has been done after doing literature survey of various approaches. The proposed work gives the complete architecture of multifunctional robot. All the functions present in robots which are used in war all with some advance features present in these multifunctional robot. Using PLM two legged robot is design and using frame per cycle technique motion detection and obstacle detection is carried out. For synchronizing its all functions propeller IC is used in which all programs are embedded.

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